

ABSTRACT

An atomic layer deposition method is used to deposit a TiN or TiSiN film having a thickness of about 50 nm or less on a substrate. A titanium precursor which is tetrakis(dimethylamido)titanium (TDMAT), tetrakis(diethylamido)titanium (TDEAT), or $\text{Ti}\{\text{OCH}(\text{CH}_3)_2\}_4$ avoids halide contamination from a titanium halide precursor and is safer to handle than a titanium nitrate. After a monolayer of the titanium precursor is deposited on a substrate, a nitrogen containing reactant is introduced to form a TiN monolayer which is followed by a second purge. For TiSiN, a silicon source gas is fed into the process chamber after the TiN monolayer formation. The process is repeated several times to produce a composite layer comprised of a plurality of monolayers that fills a contact hole. The ALD method is cost effective and affords an interconnect with lower impurity levels and better step coverage than conventional PECVD or CVD processes.